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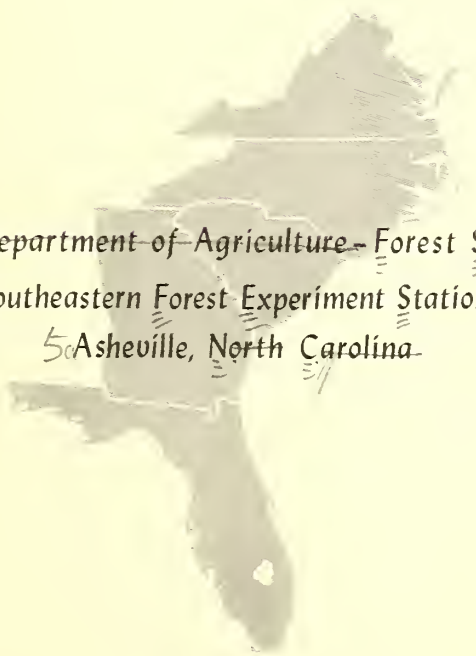

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PRETREATING TURPENTINED LONGLEAF PINE POLES TO IMPROVE PENETRATION AND RETENTION OF CREOSOTE

by
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John H. Perry, Jr.

In former times, when deep chipping was the standard method of turpentining, the lower part of the butt log in a harvested slash or longleaf pine containing the scars of turpentine faces was usually cut off or "jump-butted." This meant the loss of much potentially valuable wood, often a clear bolt 6 or 8 feet long.

In modern methods of turpentining, the bark hack cuts little if any deeper than bark thickness, and thus the round butt log (most valuable part of the tree) is sometimes used in its entirety as a pole after the tree has been "worked-out" as a gum producer. However, in some cases, trouble with penetration of preservatives in the pitch-soaked lower section behind the turpentine face has been encountered, and American Standards Association Specification No. 05.1-1948, Paragraph No. 2.4.5 for Wood Poles states, "No pole shall have a scar or turpentine face within two feet of the ground line." The ground line of poles varies with pole length. For example, for a 20-foot southern pine pole, the ground line is 4 feet from the butt; for a 50-foot pole, 7 feet; for an 80-foot pole, 10 feet. The scar, then, is usually well below the ground line in long poles made from trees that were worked only 3 or 4 years. However, in short poles and poles from trees turpentined for longer periods, there may be less than 2 feet of unscarred wood between the ground line and the face, making it necessary to remove all or part of the scar.

While jump-butts or scar-faces are sometimes sold for products such as fence posts, kindling, and pulpwood, the value of this portion of the tree is usually greater as part of a pole. This is why both the timberland owner and the treating plant operator lose when potential pole timber has to be jump-butted.

In 1961 there were about 40 treating plants in the South affected by turpentining. It is estimated that perhaps 40 more will buy worked-out turpentined poles in the next several years because of a revitalized interest in naval stores in Texas, Oklahoma, Louisiana, and Mississippi.

One treating company reports that usually from 30 to 36 inches of the butt has to be removed when it is necessary to jump-butt trees to comply with American Standards Association specifications, and that the value of the pole is reduced on the average of about one dollar. For example, if a 40-foot class 5 pole is shortened to a 35-foot class 4 pole, the value, based on current prices, drops from $7.78 to $6.64, or $1.14. This same company treats about 50,000 worked-out turpentined poles each year, most of which have to be jump-butted, so in this case jump-butting results in a loss of roughly $50,000 per annum. While these scar-faces do have a salvage value of 15 cents each to this company, the cost of jump-butting is about 10 cents per pole.

Most utility companies purchase poles on American Standards Association specifications and so do not accept poles when the scar-face is within 2 feet of the ground line. Scars near the ground line are not permitted for two reasons: (1) It is at and near the ground line that the pole is most seriously affected by decay; (2) it is generally believed that preservative penetration is unsatisfactory behind the scar-face. While cores could be taken from the face to appraise the treatment, this is not usually done because decay fungi might enter the pole through the borings even though the holes are plugged.

Several studies have been made to evaluate preservative treatment behind bark-chipped, acid-treated faces in both slash and longleaf pine. In 1948, Snow made penetration studies of test cores from a number of slash and longleaf poles with a history of 3 years of bark chipping and acid treatment.1/ These poles were given a standard 8-pound treatment at The Langdale Company, Valdosta, Georgia, after they were rossed. In the slash pine samples, preservative penetration behind the scar-faces was considered satisfactory, but penetration behind the scar-faces of longleaf poles was not satisfactory, except where the poles were incised. No reason for difference in penetration by species was given, although Snow suggested that there might be more dense pitch-soak behind the longleaf faces, since the longleaf poles grew more slowly than the slash poles.

A second study made at The Langdale Company in 1957 by the McCallum Inspection Company of Norfolk, Virginia, involved mixed slash and longleaf pine. The results were not published, but 30-day air-seasoned poles from worked-out turpentined trees showed insufficient penetration in 14.3 percent of the number treated with 12 pounds of creosote per cubic foot, in 20.3 percent treated with 10 pounds, and in 25.0 percent treated with 8 pounds. In freshly cut poles, insufficient penetration was found in 2.6 percent treated with 12 pounds and 5.8 percent treated with 10 pounds.

Because data from these studies showed erratic penetration, the need for a more thorough investigation of the problem was indicated, and in 1960 the Southeastern Station, in cooperation with the Georgia Forestry Commission,

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1/ Snow, Albert G., Jr. Turpentining and poles. South. Lumberman 177 (2225): 276, 278-279. 1948.

conducted a third study to evaluate preservative treatment behind scar-faces of worked-out turpentined trees.[2/] This study was also made at The Langdale Company. Slash pine poles seasoned 30 and 90 days, steam conditioned at 259° F. for 12 hours, and given a 10-pound treatment, treated satisfactorily. Slash pine poles treated green after steaming, and slash pine poles seasoned 90 days and treated to 8 pounds per cubic foot retention, and longleaf pine poles seasoned 30 and 90 days and treated to 10 pounds per cubic foot retention, did not meet American Wood-Preservers' Association Specification C3. As of April 8, 1960, this specification required retention by assay in southern pine poles of 7 pounds per cubic foot for 10-pound gauge retention and 6 pounds per cubic foot for 8-pound gauge retention. This is now 7.5 pounds per cubic foot for 10-pound gauge retention.

In the two studies where the poles were segregated by species, the penetration and retention behind the scar-face in slash pine was generally satisfactory when the poles were air seasoned, steam conditioned, and treated to a 10-pound retention, while it was erratic behind the scar-face in longleaf pine. Since the two species are indistinguishable after the tree is cut and peeled, it was necessary to devise a means of pretreating scar-faces so that penetration and retention would be satisfactory regardless of species. This paper describes a study to find commercially acceptable methods of pretreating longleaf pine poles.

METHODS TO INCREASE PENETRATION

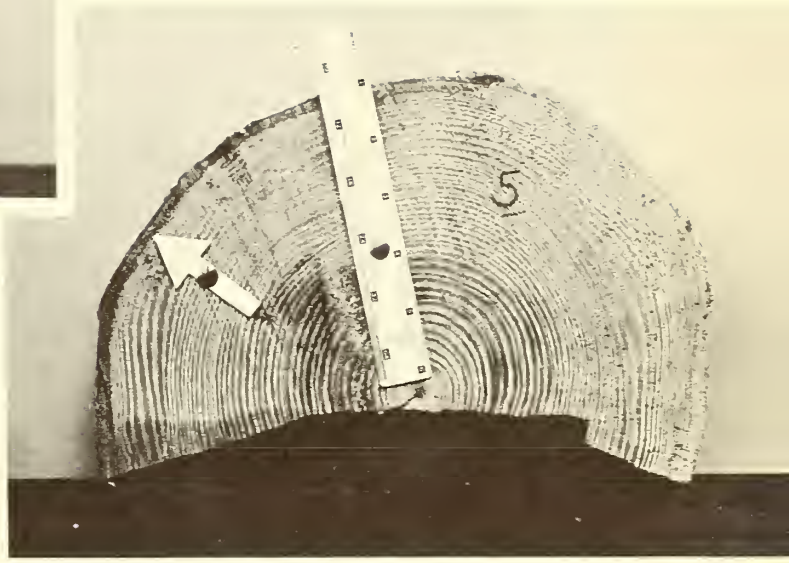
Preliminary trials were made on short bolts rather than full-length poles. Four methods were tested including incising, since Snow had experienced some success with penetration behind the few scar-faces he incised. Scar-faces for testing were cut from longleaf pine trees on the Olustee Experimental Forest near Lake City, Florida (fig. 1). Pitch-soak on these faces varied in depth and pattern (fig. 2).

Bolts containing the scar-faces were about 50 inches long and were divided into 4 groups of 5 each (fig. 3). Group A bolts were incised (fig. 4). Group B bolts were bored (fig. 5). Group C bolts were soaked in sodium hydroxide (fig. 6), and Group D bolts were soaked in gum turpentine. In each group there were matched control sections taken from alternate ends of the bolts, which were crosscut in half prior to treating.

After pretreating by these four methods, the bolts were end-coated with two coats of a resorcinol-phenol-formaldehyde resin to prevent end-penetration of creosote. The test and control bolts were then pressure treated with creosote at The Langdale Company in a charge of full-length poles. The charge was steam conditioned for 13 hours at 259° F. and treated for 3 hours.

2/ Page, Rufus H. Preservatives and turpentined utility poles. Forest Farmer 20(6): 11-12, 14. 1961.

Figure 1. --Sample trees used in evaluating methods of pretreating ranged from 9 to 16 inches d. b. h. and had been worked 4 seasons, 1957 through 1960, using a bark hack cutting a 3/4-inch streak. The streaks had been treated with a 50-percent solution of sulphuric acid.



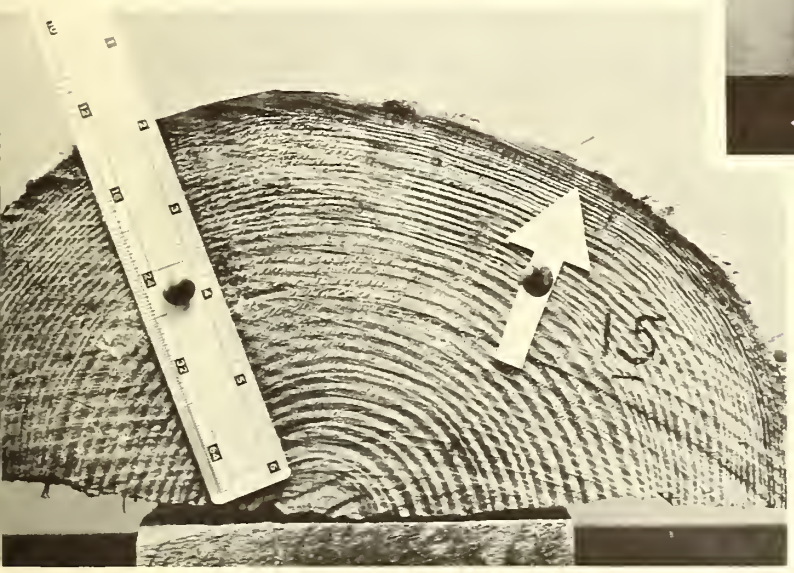


Figure 2. --Cross sections of scar-faces cut to show the pitch pattern in the vicinity of the worked-out face. Heavy pitch deposits ranged from 1/8 inch to 3/8 inch in depth, and appeared to average about 1/4 inch.

Figure 3. --The moisture content of these bolts, which were air-dried, ranged from 20.0 to 38.6 percent and averaged 28.1 percent when pretreated. The ends of the bolts were coated with an aluminum-asphalt roof coating compound containing asbestos fibers, and then wrapped in a polyethylene film to prevent excessive end checking.

Figure 4. --This homemade hand incisor had a "chisel-point" tooth 1/8 inch wide, 1/2 inch long, and 3/4 inch deep. The test bolts were incised on 1-inch centers. Hand incising is slow and laborious. It is reported that a machine method of incising only the scarface has been devised for commercial operations.

Figure 5.--Holes were bored on 1-inch centers to a depth of 3/4 inch with a 1/8-inch drill. Even though boring proved the best of four methods tested, it would probably be more costly to bore than to incise scar-faces of full length poles on a production basis.

Figure 6.--A heavy deposit of gum similar to that appearing on the test bolt at left was almost completely removed by soaking either in hot caustic or hot turpentine. The bolt on the right was treated with a 3-percent solution of sodium hydroxide at 175° F. for 4 hours. Group D bolts were kept in hot gum turpentine (165° F.) for 6 hours.

Results

Actual net retention by gauge for the charge was 8.9 pounds per cubic foot. The bolts were allowed to cool for several hours before the test cores were removed. Seven randomly selected cores were taken from the face and seven from the back of each bolt, and the sapwood thickness and depth of preservative penetration measured for each. The cores were then assayed (fig. 7).

All four methods proved satisfactory, although boring was most effective (table 1). Actually, penetration of creosote was 100 percent for both bored and incised bolts, but retention for bored bolts was 3.5 pounds more per cubic foot than for incised. However, since retention of the incised bolts (10.3 pounds) was considerably more than is required by a leading pole buyer (6.7 pounds by assay for an 8.9 pound gauge retention), it was decided to incise full-length poles for further testing and for statistical analysis because this method was satisfactory and appeared less costly to apply commercially than boring or soaking.

Figure 7. --Retention analysis of the cores from the test bolts was made at The Langdale Company's analytical laboratory. Toluene was used for extraction. The cores were placed in the extraction apparatus, heat was applied and the toluene was refluxed at a rate of 1 drop per second for 1 hour 45 minutes. Cores were then removed from the apparatus and placed in an oven to dry for 1 hour at 125° C. They were then removed to a desiccator for 15 minutes. Four drops of Nekl NS (sulfonated aliphatic polyester) were used to remove the water from the condensing tube. Five Interjoint Reflux condensers were used in the distillation process.

Table 1.--Relative effectiveness of four pretreating methods

Method of pretreating	Pretreated bolts				Control bolts			
	Penetration 1/ 2/		Retention 3/ 4/		Penetration 1/ 2/		Retention 3/ 4/	
	Face	Back	Face	Back	Face	Back	Face	Back
	- - Percent - -		Pounds per cubic foot		- - Percent - -		Pounds per cubic foot	
Boring	100.0	100.0	13.8	9.5	100.0	100.0	12.9	11.9
Incising	100.0	100.0	10.3	9.7	92.8	100.0	10.2	8.8
Caustic	93.6	100.0	10.2	8.8	99.2	100.0	8.5	9.2
Turpentine	99.6	100.0	10.1	7.3	99.7	100.0	9.8	7.0

1/ Percent penetration of sapwood, average of 35 cores each method of pretreating.

2/ A.W.P.A. C4-60 (Southern pine) - for 10-pound treatment, minimum penetration, 3.0 inches or 90 percent of sapwood.

3/ By assay, average of 35 cores each method of pretreating.

4/ Retention by gauge for the charge containing the test bolts was 8.9 pounds per cubic foot. One leading pole buyer requires that retention by extraction be at least 75 percent of retention by gauge. Based on this figure, a satisfactory retention by assay for 8.9 pounds by gauge would be 6.7 pounds per cubic foot.

PROCESSING FULL-LENGTH POLES

The next step was to incise full-length poles and test penetration and retention for different seasoning periods. Of the 84 longleaf pine trees selected and marked for identification on 2 tracts near Valdosta, 63 had been turpentined and 21 had not. Twenty-one of the poles with scar-faces were cut 39 days after the other test poles. These 84 poles were divided into 4 lots of 21 poles each. They were processed in the usual manner (fig. 8). Lot I consisted of 21 scar-faced poles seasoned 68 days and incised. Lot II was made up of 21 scar-faced poles seasoned 68 days and not incised. These served as controls. Lot III contained 21 scar-faced poles seasoned 29 days and incised, and Lot IV, 21 unworked or round poles seasoned 68 days and not incised, for use in determining the relationship between midpoint and face borings. Incising was done with a hand incisor (fig. 9).

The charge in which the test poles were treated contained 1,567 cubic feet of wood. It was steamed for 13 hours at 245° F. and treated for 3 hours. Net retention by gauge at 100° F. was 11.54 pounds per cubic foot. Poles were permitted to cool for 9 hours before the cores were taken (fig. 10).

The depth of sapwood and depth of penetration of creosote were measured as soon as each core was taken from the pole. A dye was used to distinguish heartwood from sapwood where these were not clearly defined. A core was taken from the midpoint of each pole and the depth of penetration measured, after which the outer $\frac{1}{2}$ inch of all cores, except midpoint cores, was discarded and the next $1\frac{1}{2}$ inches cut from the core and retained. The outer $\frac{1}{2}$ inch, which is the richest part of the core, was discarded before

extraction analysis in order to minimize the effect of pitch on the amount of oil extracted. Analysis of the part of the core from $\frac{1}{2}$ inch to $1\frac{1}{2}$ inches from the surface is now included in American Wood-Preservers' Association specifications.

Figure 8. --Sample poles were peeled, rossed, and stacked to dry on The Langdale Company's pole seasoning yard. The average moisture content for Lot I poles just before treating was 20.1 percent, for Lot II poles 19.6 percent, for Lot III poles 30.7 percent, and for Lot IV poles 21.0 percent. Moisture content determinations were made with a resistance-type moisture meter on the fresh cut ends of the poles just after they were trimmed. Four determinations were made for each pole, two at the butt and two at the top, one from the heartwood area and one from the sapwood area. In a previous study, moisture content measurements made with a resistance-type meter were compared with those from the same poles made by oven drying a pie-shaped disc, and for most readings below 30 percent the difference did not exceed 3 percent.

Figure 9. --The scar-faces of all poles in Lot I and Lot III were incised. Incisions were made in parallel rows approximately 1 inch apart and running the length of the face. The vertical distance between incisions was about 1/2 inch. Depth of incision was 3/4 inch, the length of the chisel-point tooth.

Figure 10. --Taking cores from treated poles to sample retention and penetration of preservative. Seven randomly selected test cores were taken from the turpentine-face location of all Lot I, II, III, and IV poles. An oilcloth with numbered circular holes was used to mark the location of the test cores.

Results

There was so little variation in penetration of the test cores from the full-length poles that no statistical analysis of these data was made. However, from an analysis of retention data for Lot I poles (incised after seasoning 68 days) we would expect to obtain satisfactory retention of creosote more than 90 percent of the time. Lot III poles (incised after seasoning 29 days) showed up better in this respect, and it is estimated that the wood behind the scar-faces of these poles would meet minimum retention standards more than 99.95 percent of the time. Since the average penetration into the sapwood (table 2) for Lot III poles was also better than for Lot I poles, it is apparent that in this study poles seasoned for only 29 days and incised treated better than poles seasoned for 68 days and incised.

Lot IV poles, which consisted of poles from unworked timber, were bored where the scars would have been located if the poles had been cut from turpentined trees, and also at midpoint. Sapwood of all cores was entirely penetrated, indicating that borings obtained from the face area and from the midpoint of the poles were comparable for the purpose of analyzing preservative penetration.

Table 2. --Penetration and retention of cores from full-length test poles, by groups

Lot number	Description	Average 1/ penetration of sapwood	Individual cores meeting A. W. P. A. requirements for penetration 2/	Average retention	Individual poles meeting A. W. P. A. requirements for retention 3/
		Percent	Percent	Pounds per cubic foot	Percent
I	Turpentined, seasoned 68 days, incised	97	95	14.42	100
II	Turpentined, seasoned 68 days, not incised	93	84	13.45	86
III	Turpentined, seasoned 29 days, incised	99	97	15.97	100
IV	Round, seasoned 68 days, not incised	100	100	13.23	95

1/ Calculated by adding percent penetration of each group of cores and dividing by number of groups.
2/ Calculated by adding number of cores meeting A. W. P. A. requirements and dividing by total number of cores involved.
3/ 7.5 pounds per cubic foot by extraction.

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CONCLUSION

The results of this study show that bark-hacked, acid-treated, turpentined faces of longleaf pine should meet minimum standards of penetration and retention almost 100 percent of the time if the poles are seasoned to an average moisture content of about 30 percent and then incised and steam conditioned before treating. Incising should work equally as well for slash pine poles, since previous studies indicate that in most cases the scar-face of this species treats well without incising. It must, therefore, be concluded that wood behind both longleaf and slash pine turpentine scars will treat well enough for the poles to meet minimum specifications of both the American Wood-Preservers' Association and the American Standards Association if the poles are air seasoned, incised, and steamed.

It will be necessary for treating plants that buy worked-out turpentined poles to weigh the cost of incising against the added value of additional pole length when the tree is not jump-butted.

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